United States General Accounting Office

Report to Congressional Requesters

ARMY ACQUISITION

Air Defense Antitank System's Development Goals Not Yet Achieved

GAO/NSIAD-91-222

GAO

United States
General Accounting Office
Washington, D.C. 20548

National Security and
International Affairs Division

B-240822

May 23, 1991

The Honorable Les Aspin
Chairman, Committee on
Armed Services
House of Representatives

The Honorable John P. Murtha
Chairman, Subcommittee on Defense
Committee on Appropriations
House of Representatives

This report responds to your request that we review the Army's revised Air Defense Antitank System (ADATS) program. A 2-year development extension was approved after the system failed to meet its operational requirements in testing conducted from February to May 1990. We reported on ADATS' performance during these tests in Army Acquisition: Air Defense Antitank System Does Not Meet Operational Test Criteria (GAO/NSIAD-91-51, Dec. 10, 1990).

In this report, we recommend that the Secretary of Defense require certain analyses and test plans before he approves ADATS' production. We also suggest that Congress consider limiting further program funding until planned performance improvements are demonstrated.

Unless you publicly announce its contents earlier, we plan no further distribution of this report for 10 days. At that time, we will send copies of this report to other interested congressional committees, the Director of the Office of Management and Budget, and the Secretaries of Defense and the Army. Copies will also be made available to other interested parties upon request.

Please contact me at (202) 275-4141 if you or your staff have any questions concerning this report. Major contributors to this report are listed in appendix I.

Richard Davis

Richard Davis
Director, Army Issues

Executive Summary

Purpose

In November 1990, the Office of the Secretary of Defense approved a 2-year extension to develop the Army's Air Defense Antitank System (ADATS). The extension was necessary because during operational testing the system had failed to perform well enough to begin production in fiscal year 1991, as planned. Congress appropriated $92 million in research, development, test, and evaluation funding for the first year of the extension, and the Army has requested $97.4 million for fiscal year 1992.

At the request of the Chairmen of the House Committees on Armed Services and on Appropriations, GAO reviewed the Army's program for the 2-year extension to determine whether (1) it had resulted in ADATS' improved reliability, (2) the tests and criteria established for the extension phase would provide sufficient information on the system's performance to approve its production, and (3) the Army's cost and operational effectiveness assessment of the system was still valid.

Background

Under the fiscal year 1989 National Defense Authorization Act (P.L. 100-456), the Secretary of Defense must certify that the system has met or exceeded the Army's operational test performance criteria before procurement funds are obligated after fiscal year 1989. During operational testing, conducted from February to May 1990, the system failed to meet a number of suitability and effectiveness requirements. The 2-year extension was intended to improve ADATS' reliability.

For the 2-year extension, the Army established a series of interim reliability test criteria and stated its intention to cancel the program if the system did not meet those criteria. According to the approved baseline schedule, the first series of tests was scheduled for April 1991, and a production decision was scheduled for May 1992. However, Army officials indicated that the program schedule would be flexible, depending on the progress made in ADATS' performance.

Results in Brief

The Army has attempted to limit the risk in the ADATS program by delaying production and attempting to improve the system's reliability through a 2-year development and test effort. The Army planned to use fiscal year 1991 funding to allow ADATS to meet the first and second interim requirements of 30 and 54 hours average time between equipment failures (a 117-hour average is required at fielding). However, planned tests have been delayed because the contractor has not been able to demonstrate a high enough reliability to statistically ensure that

the system would meet its first interim criteria. Consequently, fiscal year 1992 funding for ADATS may be provided before the Army completes the reliability tests planned for fiscal year 1991. GAO believes the program remains one of high risks because

- the criteria established for the tests are such that even if they are met, further development and testing will be needed after ADATS goes into production;
- it is not clear that the planned tests will provide information on a number of important performance characteristics; and
- the basis on which the Army justified the cost-effectiveness of the system may have been too optimistic.

Principal Findings

ADATS' Reliability Is Still in Question

GAO was unable to determine whether any improvement in ADATS' reliability had occurred since operational testing because tests that were scheduled under the 2-year program extension had not been conducted. Delays have occurred for the first series of tests because the contractor has been unable to achieve sufficient confidence in the system's reliability to begin testing. The Army believes that the limited data that does exist indicates that performance may have improved. However, the data is too limited to indicate whether ADATS will meet its first required interim milestone.

In April 1991, the Army restructured the test program. The Army now plans to use two of the newly delivered and reconfigured fire units for the first series of tests instead of the fire units that had been used in previous testing. This action further delays the start of testing and precludes the Army from conducting a series of system integration or "burn-in" tests it had planned for the new fire units. It also delays the second series of tests, planned for August 1991, until fiscal year 1992. During the second series of tests, the system is required to demonstrate 54 hours' average time between equipment failures.

The Army expects that the new ADATS configuration will greatly improve reliability and that improvements will occur over the remainder of the program. However, in order to get such improvements, numerous reliability problems with components that will not be changed in the new

configuration must be fixed. In addition, modifications that the contractor has identified since operational testing have not been tested.

Criteria for 2-Year Program Extension Are Below Those Required

Reliability and operational availability criteria that have been established for the 2-year extension fall short of those required for the system. Army officials have stated their intention to request approval for low-rate production if the system achieves 85 hours' average time between equipment failures. Achieving the test reliability criterion of 85 hours' average time between equipment failures would fall short of the 117 hours required for ADATS fielding. Failure to achieve the required reliability will also increase operation and support costs. Army analysis shows about a 40-percent increase in operation and support costs at the lower level of 85 hours. Likewise, the operational availability test criterion of 63 percent falls short of the 71 percent required at fielding. Failure to achieve the required operational availability would also require additional operational testing.

Limited Information Available for Planned Follow-On Tests

Prior operational testing demonstrated that the system did not meet all of its operational effectiveness criteria, raised issues regarding ADATS' survivability, and left several critical performance areas unresolved because of a number of limitations in the live missile firing phase. In addition, live-fire testing revealed a number of vulnerability weaknesses that may affect ADATS' performance.

The Test and Evaluation Master Plan for the 2-year extension does not include information on what testing will be conducted to determine whether ADATS has met required operational effectiveness standards. For example, the plan postpones a decision on whether any testing will be conducted to evaluate ADATS' effectiveness or survivability, and it does not require live missile firings.

The Army plans to develop a test and evaluation plan for an operational-like test to be conducted at the end of the 2-year program. The Office of the Director of Operational Test and Evaluation has stated its intention to review and comment on that plan to ensure that all necessary testing is included.

Doubts About ADATS' Cost and Operational Effectiveness

The Army has conducted a series of cost and operational effectiveness analyses that show that ADATS provides marginal air defense coverage of the maneuver force. However, those analyses may be too optimistic because (1) results from operational and live-fire testing that were not included are now available and are different from the assumptions used in the analysis and (2) the complementary non-line-of-sight component of the Forward Area Air Defense System, which contributed to overall effectiveness in the analysis, is not currently funded. Further, ADATS' unit costs have risen to an estimated $16.6 million.

At the direction of the Defense Acquisition Board, the Army is conducting additional cost and operational effectiveness analyses.

Recommendations

GAO recommends that the Secretary of Defense take the following actions:

- Direct the Director of Operational Test and Evaluation to approve a test and evaluation plan that clearly states all testing that will be completed and evaluated before ADATS' production is approved. This plan should include (1) realistic operational tests that demonstrate critical performance capabilities not previously achieved and (2) live missile firings.
- Determine ADATS' continued cost-effectiveness using current cost estimates, existing and planned air defense systems, and live-fire and operational test results before production is approved. This determination should be based on the Army's revised cost and operational effectiveness analysis.

Matters for Congressional Consideration

Because the Army predicated its fiscal year 1991 funding request for the ADATS program on its ability to meet the first and second interim reliability criteria and ADATS has not met them, the Congress may wish to consider not providing additional funding until ADATS meets the second interim requirement of 54 hours average time between equipment failures.

If additional funding is provided, the Congress may wish to prohibit the Secretary of the Army from obligating such funds until the Secretary of Defense certifies to the Congress that the above conditions either have been met or no longer need to be met.

Agency Comments

As requested, GAO did not obtain official agency comments on this report. However, the information in this report was discussed with agency officials and their views were included where appropriate.

Contents

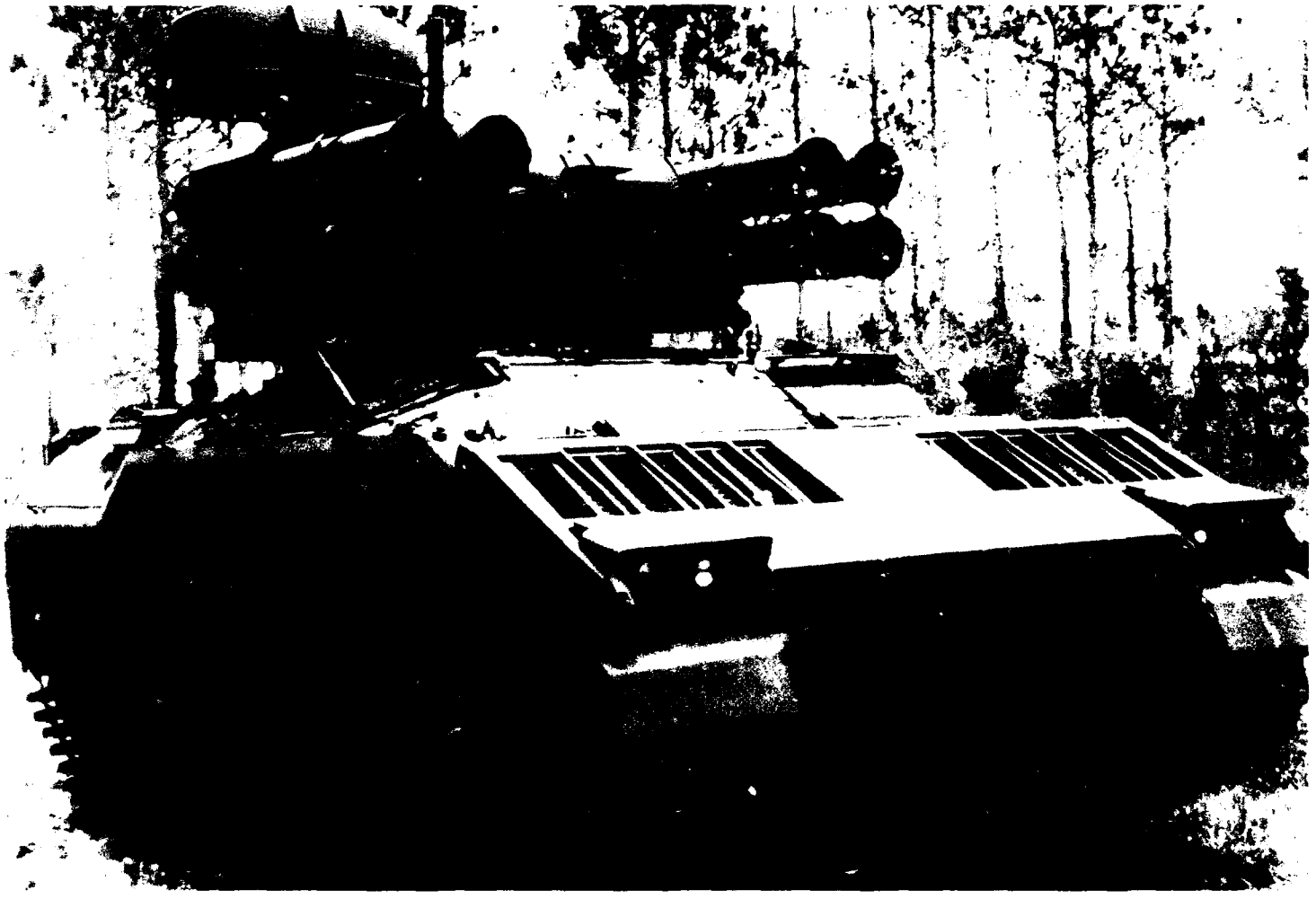
Abbreviations

ADATS	Air Defense Antitank System
GAO	General Accounting Office
OSD	Office of the Secretary of Defense

Introduction

The Army chose Martin Marietta's Air Defense Antitank System (ADATS) in November 1987 to fulfill its line-of-sight forward heavy air defense mission—one of five components of the Forward Area Air Defense System. ADATS' mission is to provide air defense coverage against helicopters and fixed-wing aircraft to the ground maneuver force of tanks and infantry fighting vehicles. ADATS uses a modified Bradley Fighting Vehicle chassis and a crew of three. The turret contains the missile subsystem and associated electro-optical and fire control equipment. Eight missiles and a radar antenna are externally mounted on the turret of each fire unit. (See fig. 1.1.)

Figure 1.1: The Air Defense Antitank System



As a nondevelopmental item, the Army expected to field ADATS to meet the early 1990s' air threat and then to enhance its capabilities through a series of preplanned product improvements. As of December 1988, the Army expected to begin production in fiscal year 1990 and to buy a total of 562 fire units at a cost of approximately $10.7 million each.

Fire Units Procured for Testing

To date, the Army has purchased eight fire units. The first four, purchased with research, development, test, and evaluation funds, were used for development and operational testing.[1] The Army also planned to use these fire units for an additional series of tests conducted by the ADATS' contractor. The remaining four, purchased under a low-rate initial production contract, have a modified Bradley Fighting Vehicle chassis and a redesigned primary power unit. These reconfigured fire units are to be used in a newly established test program during fiscal years 1991 and 1992.

Unfavorable Operational Test Results Prohibit Further Procurement

In the fiscal year 1989 National Defense Authorization Act (P.L. 100-456), the Congress directed that the Secretary of the Army be prohibited from obligating additional funding for ADATS' procurement after fiscal year 1989 until the system completed operational testing and the Secretary of Defense certified that it had met or exceeded its operational test requirements. Operational testing was conducted from February to May 1990. The system did not meet several operational test requirements.[2] Therefore, fiscal year 1990 procurement appropriations could not be obligated as had been anticipated. The Congress rescinded the fiscal year 1990 funding and did not appropriate the fiscal year 1991 procurement funding that had been requested.

Revised Program Approved in November 1990

As a result of ADATS' failure to meet its operational test criteria and continuing problems with its reliability, the Army established a special team to determine how it could be improved. The team concluded that more time was needed to fix ADATS' reliability problems and that, with additional time, it might achieve required levels of reliability. The Army subsequently proposed a 2-year development program to improve ADATS'

[1]Development test and evaluation are conducted to verify the attainment of technical performance specifications and weapon system supportability. Operational test and evaluation are conducted to determine a weapon's effectiveness and suitability under realistic field conditions.

[2]Details of the test results are contained in GAO's report Army Acquisition: Air Defense Antitank System Did Not Meet Operational Test Objectives (GAO/NSIAD-91-51, Dec. 10, 1990).

reliability, availability, and maintainability. The Defense Acquisition Board approved the Army's program and a new schedule baseline in November 1990. Congress appropriated $92 million in research, development, test, and evaluation funding for the first year of that effort, and the Army has requested $97.4 million for fiscal year 1992.

The 2-year extension plan calls for a series of tests, three of which are marked by progressively more stringent interim requirements that have been established to evaluate ADATS' reliability. The interim requirements, referred to as "exit point criteria A, B, and C," are measured by the average time between equipment failures. The Army expected exit criteria A and B to be demonstrated during fiscal year 1991. The approved Test and Evaluation Master Plan states that failure to meet any of these interim requirements demonstrates that the system is "virtually nonrecoverable" from a reliability standpoint. In addition, an Army document prepared for the Defense Acquisition Board states that failure to demonstrate the required progress at any exit point will be grounds for termination of the program.

The Army also plans to measure ADATS' operational availability in limited user tests to be conducted near the end of the 2-year period. Because ADATS did not meet its operational availability requirement during the earlier operational tests, it must successfully demonstrate sufficient operational availability before production is approved by the Defense Acquisition Board and procurement funding can be obligated. Army officials have characterized the test schedule as one driven by events, but they expect that achieving each interim measure at the time roughly specified in the approved schedule will allow the system to be ready for production at the end of the 2-year period.

Table 1.1 contains the test and decision point schedule for the 2-year period that was approved by the Defense Acquisition Board in November 1990.

Table 1.1: Approved ADATS Schedule

Decision Points	Date	Criteria
Exit A tests	Apr. 1991	30 hours between failures
Exit B tests	Aug. 1991	54 hours between failures
Exit C tests	Feb. 1992	85 hours between failures
Limited user tests	Mar./Apr. 1992	63-percent availability
Production decision	May 1992	Successful test completion

In approving the extended program, the Defense Acquisition Board required the Army to report the results of the second and third exit tests to its Conventional Systems Committee.

Objectives, Scope, and Methodology

At the request of the Chairmen of the House Committees on Armed Services and on Appropriations, we reviewed the Army's program for the 2-year extension to determine whether (1) it had resulted in ADATS' improved reliability, (2) the tests and criteria established for the extension phase would provide sufficient information on the system's performance to approve its production, and (3) the Army's cost and operational effectiveness assessment of the system was still valid.

We interviewed and obtained program documents from officials in the Army's ADATS Project Office, Operational Evaluation Command, Army Materiel Systems Analysis Activity, Cost and Economic Analysis Center, Air Defense Artillery School, and headquarters; in the Office of the Secretary of Defense's (OSD) Cost Analysis Improvement Group and Offices of the Director of Operational Test and Evaluation, Program Analysis and Evaluation, Live Fire Test, and Tactical Warfare Programs. We also reviewed documents prepared by Martin Marietta. In addition, we observed efforts to establish the test procedures for the program extension at Aberdeen Proving Ground.

We conducted our review from July 1990 to May 1991 in accordance with generally accepted government auditing standards. As requested, we did not obtain official agency comments, but we discussed the information in the report with agency officials and incorporated their views where appropriate.

The 2-Year Extension May Not Be Sufficient to Achieve All Performance Requirements

Testing of ADATS' reliability has been delayed because of continuing problems with the weapon subsystem. On April 30, 1991, the Army restructured the test program in an attempt to get the first series of tests started. The new schedule shows a delay in the first and second series of tests and a more compressed 2-year schedule. The delays make it unlikely that congressional authorization and appropriations committees will have test information that demonstrates that ADATS has met any of its interim reliability criteria before the committees make decisions on the Army's fiscal year 1992 budget request.

The Army will use two newly delivered and reconfigured fire units for the first series of tests. The Army expects these fire units to demonstrate improved reliability because the units have a redesigned primary power unit, which was the source of numerous reliability failures during prior testing. However, other components that experienced problems in operational testing have not been replaced, and retrofits that the contractor has identified to improve reliability have not been tested.

The interim criteria established for reliability and operational availability have been set at levels below required performance. Therefore, even if the system meets the interim criteria established for the 2-year program, ADATS will need additional development and testing to meet stated Army requirements. In addition, an Army analysis shows that ADATS will cost more to operate if the required levels of reliability are not achieved.

Further, a number of other performance-related deficiencies have been identified in operational and live-fire testing that go beyond reliability and operational availability. It is unclear whether the Army plans to address these during the 2-year extension because a test and evaluation plan has not been developed.

Contractor Reliability Tests Have Been Delayed

The first set of reliability tests (exit point A tests), to be conducted by the contractor, have been delayed at least 4 months because the contractor has been unwilling to begin tests. According to Army officials, the contractor has not been able to achieve an internally imposed level of statistical confidence that ADATS will meet its first interim reliability criteria. In an effort to get testing started, the Army approved a restructured testing program on April 30, 1991, that calls for two of the reconfigured fire units to be used for the exit point A tests. However, the restructuring further delays the exit point A tests and their evaluation until July 1991. The contractor will conduct the tests 24 hours a day,

7 days a week to complete them within that time. Further delays may occur because the two fire units that will be used in the tests will undergo hardware configuration changes before testing begins.

Army officials have characterized the failures that have occurred since the end of operational testing as minor. They believe that the limited data collected on the ADATS' operation since the end of operational testing shows some reliability improvements. However, the data has not been collected under record test conditions and is not sufficient to determine whether ADATS will meet its first required interim milestone of 30 hours' average time between equipment failures.

The second set of tests (exit point B tests) will also be further delayed because of the restructuring. During these tests, the interim milestones require ADATS to achieve 54 hours' average time between equipment failures. The Army expects to conduct and evaluate exit point B tests early in fiscal year 1992 instead of August 1991, as stated in the OSD-approved program. The restructured test program will also preclude the Army from determining whether modifications and production process changes have resulted in a more reliable system before formal testing begins through a series of system integration or "burn-in" tests that were planned. The project office believes that data collected from the exit A tests will be sufficient to determine whether improvements have occurred.

According to Army officials, schedule delays have also eliminated time originally scheduled after exit point A tests, a contractor-led effort, to prepare for exit point B tests, a government-led effort with contractor support. In addition, because the approved program called for the contractor to meet the exit point A criteria before the program went forward, it may be difficult to provide the additional funding for contractor support of the exit point B tests. This delay in funding could lead to further delays in the exit point B tests. Any additional delays in the second series of tests would make it unlikely that planned testing would be completed and evaluated before congressional committees made their funding decisions on the fiscal year 1992 budget request.

Expected Reliability Improvements With New Fire Units May Not Be Forthcoming

The Army expects to see improved reliability performance from the newly configured fire units that are now being delivered because the units have a newly designed and manufactured primary power unit. The older power unit has been responsible for numerous reliability failures and had to be replaced repeatedly during operational tests. However, reliability problems also have been caused by other weapon subsystem components. For example, data collected from February 1989 to December 1990 shows that ADATS' radar caused 30 percent of the hardware mission failures; the electro-optics module caused 31 percent; and the turret electro-optic console caused 25 percent. None of these components will be replaced in the redesigned fire units.

The contractor has identified numerous "fixes" that have been or will be retrofitted to the fire units. For example, over 150 fixes are planned for the radar. However, the adequacy of these retrofits will not be known until testing is completed and evaluated.

Test Criteria Are Below Requirements

The weapon subsystem reliability criteria that have been established for the 2-year extension fall short of those required in the ADATS' contract for fielding. Achieving the reliability criteria of 85 hours' average time between equipment failures that has been established as the third interim criteria would represent a marked increase from operational test results of 11 hours' average time between equipment failures but would fall short of the required 117 hours. Army officials have stated their intention to request approval for low-rate production if, at the end of 2 years, the subsystem achieved 85 hours' average time between equipment failures. The contractor would then be required to provide a plan to achieve the 117-hour requirement after the delivery of the first ADATS production units.

The interim reliability criteria that have been established for the 2-year program are based on an analysis by the Army Materiel Systems Analysis Activity. The Activity used the number of hours that would be available for testing in the Army's revised program and the ultimate reliability performance required to develop a growth curve for reliability of the weapon subsystem.[1] The interim criteria of 30, 54, and 85 hours' average time between equipment failures that have been

[1]The Activity had also developed a growth curve for the program based on its initial schedule of entering production in fiscal year 1991. However, this curve and the interim measures of performance contained on it were discarded when the system failed to achieve the required levels. According to Army reliability experts, the earlier curve assumed an unrealistic growth rate of 40 percent. The current curve assumes a growth rate of 30 percent.

established based on the curve represent the minimum threshold values that ADATS must meet to achieve its final performance requirements. According to Activity officials, any decrease in the hours available for ADATS' testing increases the risk that it will not achieve its requirements.

The operational availability criteria are set forth in the Test and Evaluation Master Plan developed to support the revised program. The criteria that have been established—which also include the time it takes to maintain components, to acquire needed spare parts, and to repair or replace broken component parts—exceed the requirement established for operational testing but fall short of those required when the system is fielded and under current force structure constraints. In the plan, the baseline weapon subsystem reliability of 85 hours' average time between equipment failures that the Army has adopted as an interim criterion for the end of the 2-year program is combined with (1) the reliability of the Bradley chassis that was demonstrated during operational testing and (2) the estimated reliability of the communications equipment that is expected to be available when ADATS is fielded.

The calculations in the plan establish an operational availability of 63 percent. Achieving that level of availability would represent an increase from operational test results of 33 percent but would fall short of the required 71-percent availability at fielding and would have consequences for the Army's maintenance force structure, among other things. Further, according to officials of the Army Materiel Systems Analysis Activity, failure to achieve the required operational availability during the current test program would require additional operational testing.

Lowered Reliability Will Result in Increased Operation and Support Costs

Failure to achieve the required reliability performance will result in increased operation and support costs. An Army analysis shows an almost 40-percent overall increase in operation and support costs if ADATS achieves 85 instead of 117 hours' average time between equipment failures. According to the Army analysis, the cost of spare parts would increase by about 100 percent. Using project office cost estimates, we determined that this would result in an increase from $524.4 million to approximately $1.049 billion. The analysis also shows that annual maintenance hours would increase by approximately 40 percent and the cost of associated support equipment would increase by about 13 percent.

Focus on Reliability and Availability Performance May Be Too Limited

The Army has established criteria for the 2-year program that are limited to testing ADATS' suitability through its reliability, availability, and maintainability performance. Although ADATS has not met reliability, availability, and maintainability criteria, OSD and our office have raised concerns about other aspects of ADATS' performance that may not be evaluated.

It is not clear whether other performance will be measured during testing because the Test and Evaluation Master Plan approved by the Director of Operational Test and Evaluation for the 2-year extension does not include information on testing that will be conducted beyond that for reliability, availability, and maintainability; nor does it establish criteria for other performance. For example, the plan postpones a decision on whether any testing related to ADATS' survivability or effectiveness will take place, and it states that the need for live missile firings will be determined at a later date. As discussed in the following sections, ADATS has not demonstrated all required capabilities.

Problems With ADATS' Survivability Have Not Been Resolved

The Army has evaluated ADATS' vulnerability and survivability through a series of live-fire and operational tests. Although the specific results are classified, the Army has identified a number of areas in which improvements are desirable. For example, the exposed missiles on top of the fire unit can be detonated with catastrophic results; the weapon subsystem is not as heavily armored as the Bradley Fighting Vehicle derivative that is used as the ADATS' chassis; and ADATS' optics are exposed to fire. The ADATS project office would like to delay a second series of live-fire tests until survivability improvements are identified and put into the fire units. The approved baseline shows that these tests will be completed in March 1992. If survivability enhancements are identified, production of them will be pursued under an ADATS preplanned product improvement program.

Because of ADATS' performance during operational tests, concerns have also been raised about the decreased probabilities of ADATS' survival due to its position in the forward battle area. In a report to the Conventional Systems Committee, OSD's Office of Operational Test and Evaluation concluded that the survivability issue was unresolved. OSD's Director of Live Fire Test has expressed similar concerns about ADATS' mission, which requires it to be positioned in the forward area.

In addition, the Army needs to determine the impact of a threat to ADATS that had not been considered in earlier tests and evaluations. The

Defense Acquisition Board directed the Army to evaluate the threat to ADATS of antiradiation missiles.

ADATS Has Not Demonstrated a Number of Effectiveness-Related Performance Requirements

The Army believes that operational suitability is the only requirement that needs to be demonstrated in the 2-year program before approval is given for ADATS to enter production because the Army believes other requirements have already been demonstrated. Accordingly, tests and test criteria in the restructured program and program documents focus on ADATS' operational suitability. However, ADATS has not demonstrated a number of effectiveness-related performance requirements. In a report on ADATS' operational testing, OSD's Office of Operational Test and Evaluation pointed out a number of limitations in the operational tests that it believed affected calculations of ADATS' effectiveness. For example, the report cites the lack of adverse weather trials and threats such as artillery, mines, and obstacles and the artificially high availability of the system that was required to start test trials. Our December 1990 report on the operational tests also identified a number of areas that were not adequately demonstrated. For example, we noted that ADATS was not tested against maneuvering targets.

Further testing of ADATS' operational effectiveness is planned to occur during the limited user tests scheduled for the end of the 2-year program only if configuration changes made to address reliability problems have an impact on effectiveness. As of May 1991, only a very small percentage of the reliability-driven configuration changes had been deemed to have a potential impact on system effectiveness. Since only 1 month has been allotted for the limited user tests, any expansion of those tests will likely take longer to conduct and evaluate than is anticipated in the approved program schedule.

The Army plans to develop a test and evaluation plan for the limited user tests to be conducted at the end of the 2-year program. OSD's Director of Operational Test and Evaluation office has stated its intention to review and comment on that plan to ensure that all necessary testing is included.

ADATS' Cost-Effectiveness Needs to Be Reevaluated

ADATS' unit costs have risen to approximately $16.6 million. Unit cost increases have been responsible in part for reductions in the number of ADATS the Army plans to buy because of overall affordability concerns. The reductions in overall program quantities will also result in fewer ADATS fire units per division providing air defense. The Army conducted a cost and operational effectiveness analysis that concluded ADATS was marginally effective at the reduced levels of air defense coverage. However, the analysis may have been too optimistic because results from operational and vulnerability testing that were not included in the analysis are now available and are different from the assumptions used in the analysis. In addition, the non-line-of-sight air defense system, which was expected to work in tandem with ADATS and was included in the analysis, is no longer a funded program.

Although the Army is conducting further cost and operational effectiveness analyses at the direction of the Defense Acquisition Board, it is not clear when the results of these analyses will be available.

Unit Cost Increases Have Resulted From Decreased Quantities and Program Delays

The December 1989 and 1990 selected acquisition reports show that production unit costs have increased more than 36 percent over the 1989 estimate and 55 percent over the 1988 estimate to about $16.6 million per fire unit.[1] Total program production cost estimates have changed only slightly—from about $6.8 billion for 562 fire units planned in 1989 to about $6.3 billion for the 378 fire units the Army currently plans to buy. These cost estimates may change when the required independent cost estimate is completed because OSD cost analysts believe that production costs have been overstated and support costs have been understated.

ADATS' unit cost increase triggered additional congressional reporting requirements, as called for under 10 U.S.C. section 2433, which states that the Army must certify to the Congress that (1) the program was essential to the national security, (2) there were no alternatives that will provide equal or greater military capability at less cost, (3) the new unit cost estimates were reasonable, and (4) the management structure was adequate to control unit costs.

According to a 1990 selected acquisition report, the unit costs increased because (1) fire unit quantities had been reduced, (2) production rates had been reduced from seven a month to three a month, and (3) the

[1]The cost includes an ADATS fire unit with missiles.

production start had been delayed 2 years. We believe further delays in production, reductions in quantities, or hardware changes such as those being contemplated for survivability upgrades or to improve reliability are likely to result in additional unit cost increases. In addition, as discussed in chapter 2, further increases in the cost of supporting ADATS once it is fielded will also occur if the system does not meet its reliability requirement of 117 hours' average time between equipment failures.

Cost-Effectiveness Calculations Affected by Program Changes

The Army has conducted a series of cost and operational effectiveness analyses for the Forward Area Air Defense System that determined that ADATS was a cost-effective system. The most recent analysis, conducted in 1987, used a brigade-level scenario to compare ADATS' effectiveness at 36 and 24 fire units per division. The 36 fire units represent the force structure under the Army's December 1988 planned buy, while 24 fire units represent, the force structure under the currently planned buy.

The analysis showed that ADATS provided marginal air defense coverage to the maneuver force at 24 fire units per division. That is, ADATS was effective if it did not sustain irreplaceable losses. These losses can be from maintenance-related failures as well as from battle damage. Subsequent vulnerability results from live-fire testing and reliability and maintainability results from the operational tests suggest that irreplaceable losses will occur more frequently than had been assumed. For example, the cost and operational effectiveness analysis assumed that ADATS would be available to conduct its mission 100 percent of the time, when test results show a demonstrated operational availability of less than 40 percent.

The analysis also assumed that the complementary non-line-of-sight component of the Forward Area Air Defense System would be in place. That component contributed to the effectiveness of air defense coverage in the analysis. However, the program is not currently funded, and therefore, its contribution to future air defense capabilities is questionable.

New Data May Not Be Ready as Planned

At the direction of the Defense Acquisition Board, the Army is updating the cost and operational effectiveness analysis that was originally conducted for the Forward Area Air Defense System to (1) look at the impact of reduced fire units on the division level, (2) include test results, and (3) evaluate the antiradiation missile threat to ADATS. Interim results

are to be made available to OSD prior to the exit point B review by the Conventional Systems Committee, currently scheduled for October 1991.

However, according to Army officials, existing models and computer software make it difficult to conduct a simulated battle at the division level. In addition, new scenarios that reflect the post-conventional force reduction environment are needed to conduct the simulations. These new scenarios have not yet received Army approval. Moreover, according to Army officials, the data needed to examine ADATS' survivability will not be available until after the second phase of live-fire tests is conducted and evaluated. Therefore, the Defense Acquisition Board-directed analysis is proceeding slowly, and Army officials do not believe that results will be available when requested.

Conclusions, Recommendations, and Matters for Congressional Consideration

Conclusions

The Army has attempted to limit the risk in the ADATS program by delaying production and attempting to improve the system's reliability through a 2-year development and test effort. The Army planned to use the fiscal year 1991 funding to allow ADATS to meet the first and second interim reliability requirements of 30 and 54 hours' average time between equipment failures (a 117-hour average is required at fielding). However, planned tests have been delayed because the contractor has not been able to demonstrate a high enough reliability to statistically ensure that the system would meet its first interim criteria. Consequently, fiscal year 1992 funding for ADATS may be provided before the Army completes the reliability tests planned for fiscal year 1991. Our review indicates that the program remains one of high risks because

- the criteria established for the tests are such that even if they are met, further development and testing will be needed after ADATS goes into production;
- it is not clear that the planned tests will provide information on a number of important performance characteristics; and
- the basis on which the Army justified the cost-effectiveness of the system may have been too optimistic.

Recommendations

We recommend that the Secretary of Defense take the following actions:

- Direct the Director of Operational Test and Evaluation to approve a test and evaluation plan that clearly states all testing that will be completed and evaluated before ADATS' production is approved. This plan should include (1) realistic operational tests that demonstrate critical performance capabilities not previously achieved and (2) live missile firings.
- Determine ADATS' continued cost-effectiveness using current cost estimates, existing and planned air defense systems, and live-fire and operational test results before production is approved. This determination should be based on the Army's revised cost and operational effectiveness analysis.

Matters for Congressional Consideration

Because the Army predicated its fiscal year 1991 funding request for the ADATS program on its ability to meet the first and second interim reliability criteria and ADATS has not met them, the Congress may wish to consider not providing additional funding until ADATS meets the second interim requirement of 54 hours' average time between equipment failures.

If additional funding is provided, the Congress may wish to prohibit the Secretary of the Army from obligating such funds until the Secretary of Defense certifies to the Congress that the above conditions either have been met or no longer need to be met.

Major Contributors to This Report

National Security and International Affairs Division, Washington, D.C.	Henry L. Hinton, Associate Director Raymond Dunham, Assistant Director Katherine Schinasi, Evaluator-in-Charge Robert Shields, Staff Evaluator
Atlanta Regional Office	T. Wayne Gilliam, Regional Management Representative Christopher Keisling, Staff Evaluator